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THE COLOR PHASES OF DOWNY MUTE SWANS

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The terms "gray" and "white" have traditionally been used to describe the 2 color phases of the downy Mute Swan (*Cygnus olor*). While the terms are satisfactory for field and laboratory use, they give no indication of any brighter colors that might be present in the plumage or unfeathered parts. When I examined 3 live, newly-hatched cygnets from Rhode Island in 1967 and 3 from Michigan in 1970, I found that not only were there traces of color present in both phases, but also that these traces could be measured. Accordingly, color measurements were taken using Ridgway's *Color Standards and Color Nomenclature* (by the author, Wash., D.C., 1912) and the *Atlas de los Colores* (Villalobos, El Ateneo, Buenos Aires, 1947); these were subsequently equated with glossy samples from the Munsell *Book of Color* (Munsell Color Co., Baltimore, 1966). I made color and line sketches, took black and white photographs, and prepared a chart, part of which is shown in Table 1.

The mechanism behind the occurrence of color phases in the Mute Swan is now known to be a single sex-linked recessive gene (Munro et al., Auk 85: 504–505). The Michigan cygnets (1 gray ♂, 2 white ♀♀) were the offspring of a "Polish" (= white) cob and a Royal (= gray) pen. Charles Willey reported (pers. comm.) that the Rhode Island cygnets (2 gray, 1 white, all ♀♀), shipped as star-pipped eggs, had a "dominant" female parent and a male parent of "questionable" dominance, which turned out to have been heterozygous. All 3 of the gray cygnets examined had only one gene for gray color: the Michigan male was heterozygous for white; the 2 Rhode Island females were monozygous. Sex of the cygnets was determined by cloacal examination.

One might expect the cygnets of homozygous Royal parents to be grayer, with darker bills and feet, than cygnets of mixed parentage. Although I have not had the opportunity to examine such cygnets in the hand, 2 other observations

TABLE 1

COLOR ANALYSIS OF PLUMAGE AND UNFEATHERED PARTS OF MUTE CYGNETS

Color Authority	Underparts	Upper back	Upper mandibles	Tarsi
		Gray phase		
Villalobos	N–19	0–13–2°	N–7	00S–9–1°
Munsell	N 9/	10 YR 6/1.5	N 4/	10 YR 4/0.5
Ridgway*	± White	XLVI Smoke Gray	LI Iron Gray/LI Dark Olive-Gray	LI Dark Olive-Gray/LI Deep Olive-Gray
		White phase		
Villalobos	N–19	00S–17–4°	0–9–1°	00S–(11–13)–5°
Munsell	N 9/	10 YR 8/2	10 YR 5/1.5	7.5 YR 6/4–6.5/4
Ridgway*	± White	XL Tilleul Buff	XLVI Dark Grayish-Olive/LI Deep Olive-Gray	XL Wood Brown/XL Avellaneous

* Plate number and named color only. The diagonal (/) is a regular part of the Munsell notation; used elsewhere, it denotes a shade *between* those given on either side of it.

suggest that the expectation is reasonable. A brood of extremely dark-billed, dark-footed cygnets that I saw in 1969 in Shubenacadie, N. S., had "no known recessive ancestry" (Eldon Pace, pers. comm.), and the bill and feet of an unsexed, newly-hatched captive Royal cygnet were described in 1964 as "charcoal gray" by the bird's owner, Carroll Smith (letter with color slide). Certainly, if heterozygous cygnets are lighter in color than are homozygous gray cygnets, a good color standard would be useful in assessing the amount of variation between them.

The so-called white cygnet is not lacking in *color* (see frontispiece), but only in the larger amount of neutral darker pigment that is present in cygnets of the gray phase. Actually, the "true colors" of the Mute cygnet are revealed most clearly in the white phase. This phenomenon is seen nowhere better than in the colors of the upper back and feet (see Table 1). In both cases, the colors of these parts in white phase cygnets are discernibly lighter (higher in *value*) and brighter (greater degree of *chroma*) than are the colors of corresponding areas on gray-phase cygnets. Thus, the gray and white phases of the Mute cygnet seem not to be a case of "either/or" but of "more or less," a condition that suggests 2 pairs of alleles (unpaired in ♀♀), one for *more* gray (= gray cygnet) and one for much *less* (= white cygnet), with still another pair of alleles to provide a more or less constant amount of pale, delicate *chromatic* pigment (hue) for both phases.

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NEW LIFE MEMBER

Martha Hatch Balph has recently become a life member of the Wilson Ornithological Society. Dr. Balph is an Adjunct Assistant Professor in the Department of Wildlife Science, Utah State University, Logan. Her primary interest in ornithology is behavior. She has published several papers in professional journals based upon her research in passerine ontogeny and social behavior. She belongs to the AOU, COS, Animal Behaviour Society, Ecological Society of America, and several other scientific associations. In addition to her professional interests, Dr. Balph enjoys hiking, skiing, and zoological illustrating. She is married to Dr. David F. Balph, who is also a behaviorist on the faculty of the Department of Wildlife Science at USU; they have two sons.